IN THE DRAWINGS

The attached sheet of drawings includes changes to Figure 4. This sheet, which includes Figure 4 and 5, replaces the original sheet including Figures 4 and 5.

Attachment: Replacement Sheet

REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1, 3, 5-11, 13, and 15-20 are currently pending in the present application, Claims 2 and 12 having been previously canceled. Claims 1, 3, 5, 6, 8-11, 13, 15, 16, and 18-20 have been amended, and Claims 4 and 14 have been canceled without prejudice or disclaimer by way of the present amendment. Support for the amendments may be found in the original disclosure, at least in, Figures 1-4, and the corresponding descriptions. Thus, no new matter has been added.

In the outstanding Office Action, the Drawings were objected to for not showing every feature of the invention specified in the claims; Claims 3 and 13 were objected to for containing improper multiple dependencies; Claims 4-8 and 14-18 were objected to due to informalities; Claims 1 and 11 were rejected under 35 U.S.C. §103(a) as unpatentable over Nishioka et al. ("Circular Type Quantum Key Distribution," IEEE Photonics Technology Letters, Vol. 14, No. 4, April 2002, hereinafter "Nishioka") in view of Hidehiko et al. (JP 05-241104, hereinafter "Hidehiko"); Claims 4, 6-8, 14, and 16-18 were rejected under 35 U.S.C. §103(a) as unpatentable over Nishioka and Hidehiko, in further view of Negami et al. (U.S. Patent No. 5,471,545, hereinafter "Negami"); Claims 5 and 15 were rejected under 35 U.S.C. §103(a) as unpatentable over Nishioka, Hidehiko, and Negami, in further view of Bethune et al. (U.S. Patent No. 6,188,768, hereinafter "Bethune"); Claims 9 and 19 were rejected under 35 U.S.C. §103(a) as unpatentable over Nishioka and Hidehiko, in further view of Sedylmayr (U.S. Patent No. 6,188,768); and Claims 3, 10, 13, and 20 were rejected under 35 U.S.C. §103(a) as unpatentable over Nishioka, Hidehiko, and Bethune.

As an initial matter, Applicants have amended Figure 4 in order for 303 in (A), (B), and (C) to better visually correspond to the 303 of (D), (E), and (F). Accordingly, no new matter has been added as a result of this amendment.

With regard to the objection to the Drawings, the outstanding Office Action asserts, on page 2, that features of Claims 3-5 and 13-15 are not shown in the figures. Applicants respectfully submit that Claims 3 and 13 have been amended to recite that a single phase modulator is configured as the first phase modulator and configured as the second phase modulator. The phase modulator corresponding to both the first and second modulators may be found in, at least, Figure 3. Furthermore, Claims 4 and 14 have been canceled, thereby rendering the objection corresponding to these claims moot.

With regard to the assertion that the feature of "phase difference corresponding to the value of the random number bit and the 180-degree phase difference between the orthogonally polarized components are produced at the same time," recited in Claims 5 and 15, is not shown in the figures, Applicants respectfully traverse this assertion. Applicants respectfully submit that the above-noted feature is shown in Figure 3, through the communication of phase modulator (34), polarization beam splitter (31), and ports (311, 312, 313). In addition, at least pages 28-29 of the specification describe the above feature while referencing Figures 3 and 4.

Accordingly, based on the above discussion, Applicants respectfully request that the objection to the Drawings be reconsidered and withdrawn.

With regard to the objection to Claims 3 and 13, Applicants have amended Claims 3 and 13 to clarify that a single phase modulator is configured as the first phase modulator and configured as the second phase modulator. Applicants respectfully submit that Claims 3 and 13 "further limit the subject matter of" independent Claims 1 and 11, respectively. Specifically, Claims 1 and 11 recite distinct elements (i.e., first phase modulator and second

phase modulator) that perform different functions (see recited features of Claims 1 and 11). Dependent Claims 3 and 13 further define these elements by reciting that a single phase modulator is configured as both the first and second modulator. Accordingly, Applicants respectfully request the objection to Claims 3 and 13 be reconsidered and withdrawn.

With regard to the objection to Claims 4-8 and 14-18, the Office Action asserts, on page 4, that "the phase difference" in line 4 of Claims 4 and 14 is unclear. Applicants respectfully note that since Claims 4 and 14 have canceled by way of the present amendment, this objection is moot. Accordingly, Applicants respectfully request the objection to Claims 4-8 and 14-18 be reconsidered and withdrawn.

Addressing now the rejection of Claims 1 and 11 under 35 U.S.C. §103(a) as unpatentable over Nishioka and Hidehiko, Applicants respectfully traverse this rejection.

Claim 1 recites, in part,

> a transmission path for serving as a transmission medium of light;
> a first station which emits time-divided optical pulses into the transmission path, returns optical pulses modulated at a second station into the transmission path, and measures a phase difference between the optical pulses returning from the transmission path; and
> the second station including,
> a polarization beam splitter splitting the time-divided optical pulses into first orthogonally polarized components and second orthogonally polarized components,
> a first phase modulator receiving the first of the split optical pulses and producing the phase difference corresponding to a value of a random number bit between the time-divided optical pulses, and
> a second phase modulator receiving the second of the split optical pulses after polarization direction of the second of the split optical pulses is rotated by 90 degrees, producing a same phase difference as the first phase modulator between the first of the optical pulses, and modulating the orthogonally polarized components of each optical pulse to have a phase difference of 180 degrees therebetween,

> wherein an output of the first phase modulator is combined with an output of the second phase modulator after the polarization direction is rotated by 90 degrees, and then the combined output returns into the transmission path.

Claim 11 recites a corresponding method claim.

The outstanding Office Action asserts, on pages 4-6, that the combination of Nishioka's Figure 3 and Hidehiko's Figure 5b describes the features of Claim 1. Applicants respectfully traverse this assertion.

The Office Action asserts that station Alice of Nishioka's Figure 3 corresponds to the claimed second station. Applicants respectfully submit that Nishioka does ***not*** describe or suggest at least the claimed second station. Specifically, Applicants note that Nishioka does not describe ***splitting time-divided optical pulses*** (emitted by a first station) ***into first and second orthogonally polarized components***.

In addition, Nishioka does not disclose that the second station includes a first phase modulator receiving the first of the split optical pulses and producing the phase difference corresponding to a value of a random number bit between the time-divided optical pulses. The Office Action asserts, on page 5, that Nishioka discusses such feature by noting that "Nishioka discloses phase modulating photons with quantum key information," and that "quantum key is a random string of bits shared by communicating devices for security purposes." However, Applicants note that a mere recitation of phase modulating photons with quantum key information does ***not*** equate to the claimed feature of ***producing the phase difference corresponding to a value of a random number bit between the time-divided optical pulses***.

Nishioka also does not describe that the second station further includes a second phase modulator ***receiving the second of the split optical pulses after polarization direction of the second of the split optical pulses is rotated by 90 degrees, producing a same phase***

difference as the first phase modulator between the first of the optical pulses, and ***modulating the orthogonally polarized components of each optical pulse to have a phase difference of 180 degrees*** therebetween.

Additionally, Applicants respectfully submit that Nishioka does not describe or suggest the combining feature recited in Claim 1. The outstanding Office Action asserts, on page 6, that the polarization beam splitter (PBS) in the Alice station performs the claimed combining feature. However, Applicants respectfully submit that nothing in Nishioka discloses ***combining an output of the first phase modulator with an output of the second phase modulator after the polarization direction is rotated by 90 degrees***, and then returning the combine output into the transmission path. Accordingly, Applicants note that absent a disclosure that the PBS performs the recited feature, it can not be assumed that such a feature is indeed performed.

Nishioka discloses different configurations of Alice, which is asserted by the outstanding Office Action to correspond to the claimed second station. Specifically, Nishioka's Figure 1 shows a circular type quantum key distribution (QKD) system in which Alice includes a phase modulator (PMA). Figure 2 shows a Geneva group's QKD system in which Alice includes a Faraday mirror that is connected to a PMA. However, Nishioka merely discloses that the behavior of the avalanche photo diodes (APDs) (located in the Bob station) in the mixed system of Figure 3 is the same as the behavior of the system presented in Figure 1, and concludes that the different behaviors of the systems of Figures 1 and 2 are caused by the difference between the loop optics (located in Alice of Figure 1) and the Faraday mirror (located in Alice of Figure 2).[1] Thus, Nishioka does not (and can not) describe the features of Claim 1.

[1] Nishioka: page 577, column 2, last paragraph

The Hidehiko reference does not cure the above-identified deficiencies of Nishioka. However, the outstanding Office Action asserts, on page 6, that Hidehiko describes a 90 degree rotation in the polarization domain, which causes a 180 degree shift in the phase domain. Applicants respectfully traverse this assertion.

Even assuming *arguendo* that Hidehiko shows a 180 degree shift in the phase domain, Hidehiko still does ***not*** describe a second phase modulator ***receiving the second of the split optical pulses after polarization direction of the second of the split optical pulses is rotated by 90 degrees*** and ***modulating orthogonally polarized components of each optical pulse to have a phase difference of 180 degrees*** therebetween. In addition, Applicants note that a mere recitation of rotating polarization direction by 90 degrees does not equate to the above-noted claimed features.

Accordingly, based on the preceding remarks, the combination of Nishioka and Hidehiko does not describe, suggest, or render obvious all of the features of Claims 1 and 11. Thus, Applicants respectfully request the rejections of Claims 1 and 11, and claims depending respectively therefrom, be reconsidered and withdrawn.

Consequently, in view of the present amendment and in light of the above discussions, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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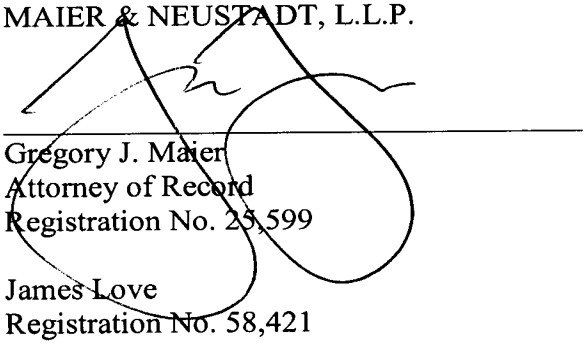
MAIER & NEUSTADT, L.L.P.



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